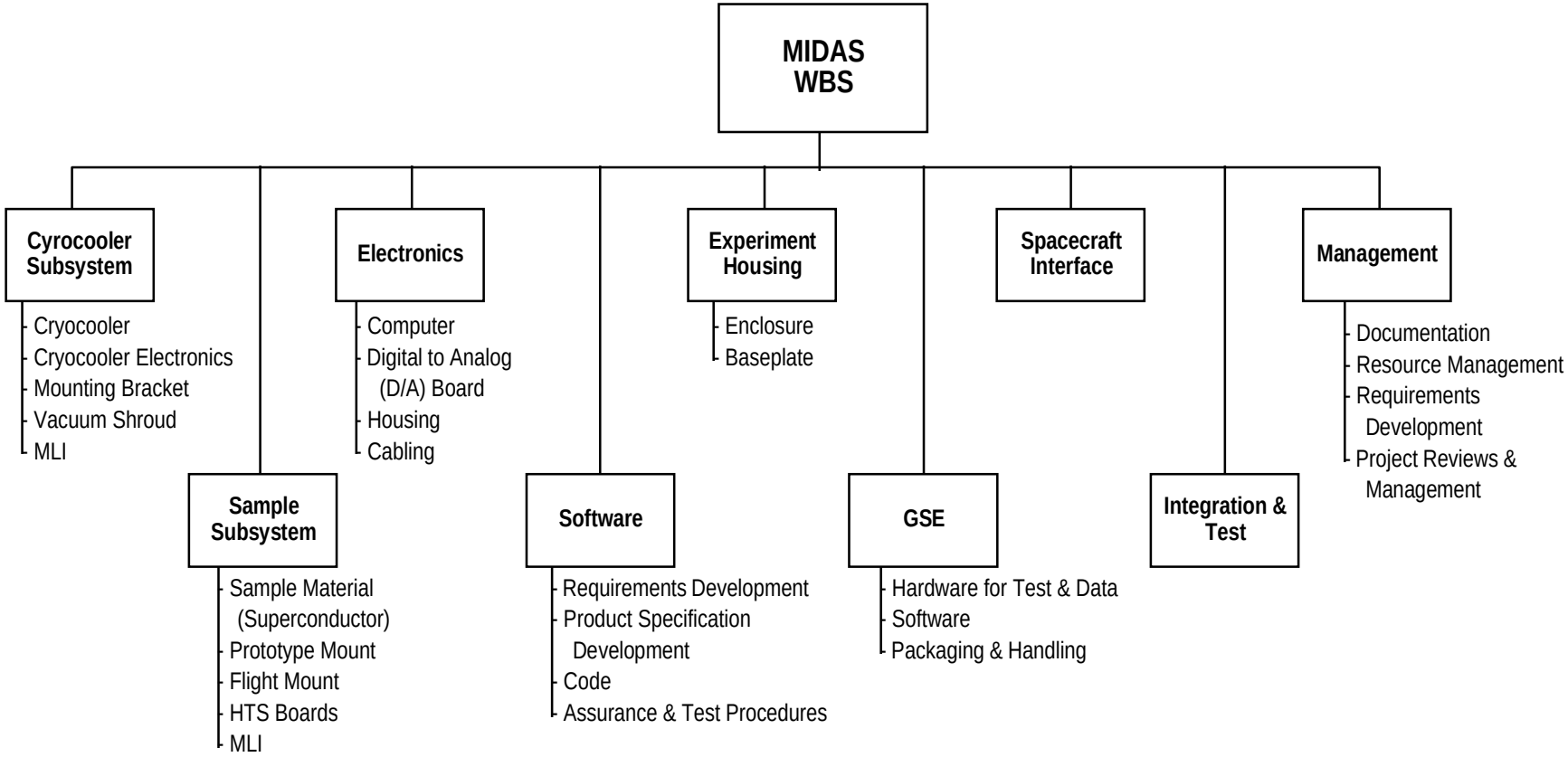
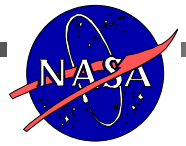
Work Breakdown Structure



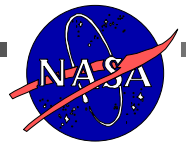
Test History

- Development test to select adhesive for bonding YSZ to copper cube
  - » Stycast 2850FT
- Support bracket vibration tested
- Ruggedized electronics box vibration tested



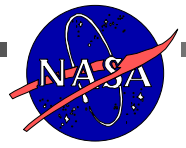
Acronym List

- ADC Analog to Digital Converter
- CG Center of Gravity
- CM Configuration Management
- DAC Digital to Analog Converter
- DMA Direct Memory Access
- FEA Finite Element Analysis
- FMEA Failure Modes and Effects Analysis
- HTS High Temperature Superconductors
- Jc Critical Current Density
- JSC Johnson Space Center
- KSC Kennedy Space Center
- LaRC Langley Research Center
- LHB Langley Handbook
- MIDAS Materials in Devices as Superconductors
- MLI Multi Layer Insulation
- NSTS National Space Transportation System
- OSAT Office of Space Access and Technology



Acronym List (cont'd)

- OSEMA — Office of Safety, Environmental, & Mission Assurance
- SSP — Space Shuttle Program
- STS — Space Transportation System
- TBD — To Be Determined
- Tc — Critical Transition Temperature
- YSZ — Yttria Stabilized Zirconia

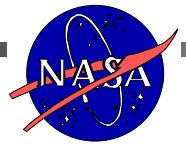


Structural Analysis

Jill Marlowe

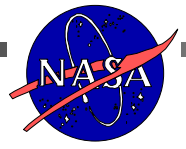
Analysis and Test Engineering Branch

August 7, 1995



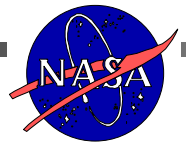
Structural Analysis Status

	COMET	***Shuttle***
Electronics Box	FEA: 16.8g per axis σ_{VM} = 25 ksi FS_{Yield} = 1.44 in mounting feet	Analysis to be done on new box. Stresses in feet should be less with new box.
Support Plate (Modal Analysis)	Dim: 29" x 11" x .3" Aluminum 1st mode (plate) = 21 Hz 1st mode (experiment) = 159 Hz	Dim: 19" x 16" x .25" Aluminum Analysis to be done. Expect higher 1st bending mode.
(Stress Analysis)	FEA: 12g per axis (simply supported edges) σ_{VM} = 9.5 ksi, FS_{Yield} = 3	Analysis to be done (elastic foundation in MDL).
Support Bracket and Cone (Modal Analysis)	1st mode = 260 Hz; 3 other modes < 1000 Hz (dominated by bracket)	Analysis to be done. Cone and cold tip supported by vacuum chamber. Expect higher modes.
(Stress Analysis)	σ_{VM} = 4.4 ksi, FS_{Yield} = 7 (bracket) σ_{VM} = 1.5 ksi, FS_{Yield} = 24 (cone)	Analysis to be done. Expect equal or lower stresses.



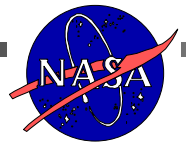
Structural Analysis Status (cont'd)

	COMET	***Shuttle***
Copper Ribbon	• Assessed for axial, lateral, and buckling stiffness relative to various cube mounting concepts. • Loads travel through cube support when there is slack in the Cu ribbon.	No change in design
Vacuum Chamber	20 psi external load: Min. thickness = .125" $p_{CRIT\ BUCK}$ = 3 ksi $\sigma_{VM\ max}$ = 1.6 ksi	Analysis being performed. Thickness not expected to be critical due to smaller size, thicker walls, and low stresses/buckling pressure.
Cube Support	Seven shapes evaluated. Tapered circular cone selected based on lateral/axial/torsional deflections, stress and critical buckling loads. Wall/flange thickness optimized based on thermal criteria while maintaining stress, bolt force and buckling requirements.	No change in design.



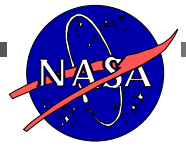
Structural Analysis Status (cont'd)

	COMET	***Shuttle***
Vacuum Chamber Bolt Sizing	FEA: 16.8g per axis 10 #10-32 UNC bolts: MS_{Yield} = 0.18 10 #8-32 UNC bolts: MS_{Yield} = 0.12	Analysis to be done. Vacuum chamber is lower to the interface plate, supports less weight, and better distributes load to base. Expect similar bolts to be adequate.



Agenda

- WBS
- Schedule
- Cost
- Workforce
- Commercial Partnerships
- Product Assurance Plan
- Logistics

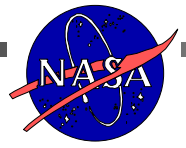


Thermal Analysis

Ruth Amundsen / Debra Shimek

Analysis and Test Engineering Branch

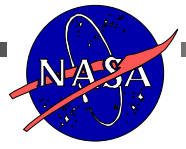
August 7, 1995



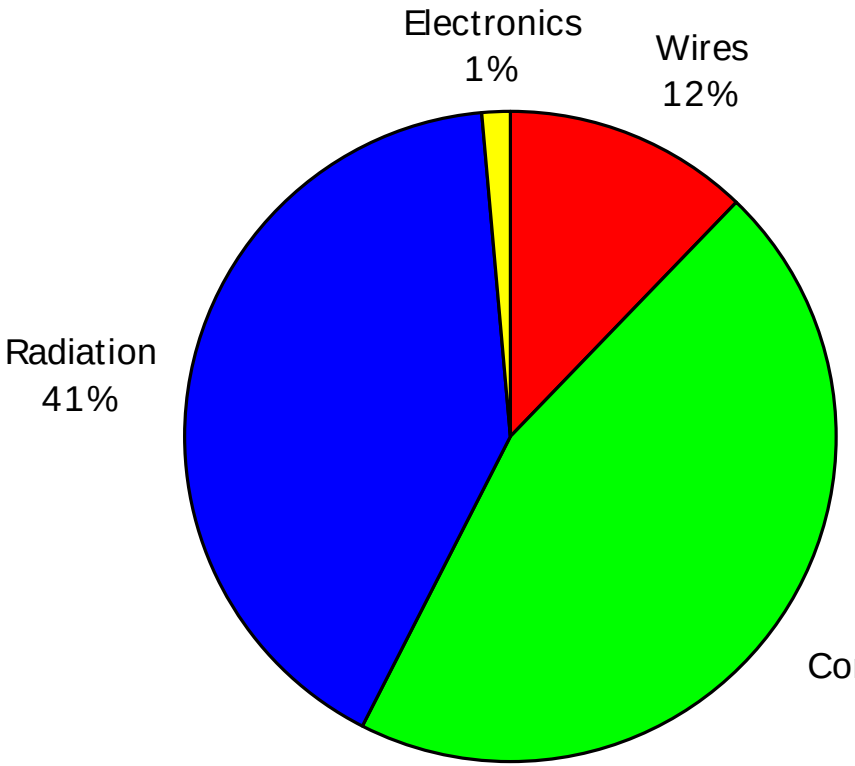
Thermal Analysis Status

Analysis goal	COMET	Shuttle
Load on cryocooler cold-tip	Used TRW pulse tube. 30% margin on cryocooler load (see chart).	TI tactical cryocooler has 250% higher load capability (1W). 50% margin expected. Minimal changes to cold-tip loading; analysis to be re-run.
Gradient on HTS boards (<0.25K change during measurement)	Gradients met requirement (see thermal map).	No change in design due to carrier change.
Instrument model (component hot/cold cases)	All components within acceptable ranges.	Change in design based on fan cooling has been initially modeled (see table). Detailed analysis to be done.

Note: TRASYS, SINDA-85 and P3/Thermal used in thermal analyses



Thermal Analysis -- Load on Cryocooler

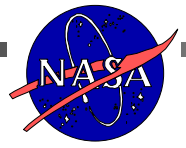


Total heat load 312 mW

MLI e* = 0.04, 0.02

Thermal Analysis -- Fan Selection

- Whisper XL DC (Comair/Rototron) selected
- Flight history on LASE
- 28-99 cfm flow rate -- 85 cfm for MIDAS voltages
- 18 cfm calculated to hold components to 10°C temperature rise
- Factor of 1.5 used to account for screen/filter restriction
- More detailed thermal/flow analysis to be done to determine optimum placement



Thermal Analysis -- Component Status

Component (Op temps)	Cold Limit (°C)	Cold Prediction (°C)	Hot Prediction (°C)	Hot Limit (°C)
Fan	-10	5	53 (max power) 48 (nom power)	70
Ion Pump	0	5	49 (max power) 47 (nom power)	45
Cryocooler	-54	5	67 (max power) 56 (nom power)	71
Electronics Box	-25	5	56 (max power) 49 (nom power)	70

Note: the top hot case predictions use maximum power steady-state, which is unreasonably conservative. The steady-state analysis with nominal powers is also shown. For the ion pump, the nominal power is not yet known, so maximum was used.

Thermal Analysis Status -- Carrier Temps

- Operational Temps
  - » STS: 18 to 30°C
  - » Priroda: 5 to 40°C
- Survival (non-op) Temperatures
  - » STS and associated transport: 0 to 49°C
  - » Priroda and associated transport: -50°C to +50°C (can waive -50°C req. as done on MAPS)